WE CLAIM:

1. A reactor for CO control comprising:

a reactor vessel having a water-gas shift catalyst zone, a mixed catalyst zone downstream of the water-gas shift catalyst zone, and a methanation catalyst zone disposed downstream of the mixed catalyst zone;

at least one water-gas shift catalyst disposed in said water-gas shift catalyst zone;

at least one methanation catalyst disposed in said methanation catalyst zone; and

a mixture of said at least one water-gas shift catalyst and said at least one methanation catalyst disposed in said mixed catalyst zone.

2. A reactor in accordance with Claim 1, wherein said mixture comprises a catalytic gradient whereby a concentration of said at least one methanation catalyst increases in a direction of said methanation catalyst zone.

3. A reactor in accordance with Claim 1, wherein said at least one water-gas shift catalyst comprises Cu and Zn.

4. A reactor in accordance with Claim 1, wherein said at least one methanation catalyst is selected from the group consisting of nickel, iron, ruthenium, platinum, rhodium and alloys and combinations thereof.

5. An apparatus for conversion of a hydrocarbon fuel to a fuel gas suitable for use in a fuel cell comprising:

a reformer vessel suitable for reforming said hydrocarbon fuel to a reformed gas mixture comprising CO, CO_2, H_2O and H_2;

a reactor vessel having a water-gas shift catalyst zone, a mixed catalyst zone downstream of said water-gas shift catalyst zone, and a methanation catalyst zone downstream of said mixed catalyst zone in fluid communication with said reformer vessel; and

at least one water-gas shift catalyst disposed in said water-gas shift catalyst zone, at least one methanation catalyst disposed in said methanation catalyst zone, and a mixture of said at least one water-gas shift catalyst and said at least one methanation catalyst disposed in said mixed catalyst zone.

6. An apparatus in accordance with Claim 5, wherein said mixture comprises a catalytic gradient whereby a concentration of said at least one methanation catalyst increases in a direction of said methanation catalyst zone.

7. An apparatus in accordance with Claim 5, wherein said at least one water-gas shift catalyst comprises Cu and Zn.

8. An apparatus in accordance with Claim 5, wherein said at least one methanation catalyst is selected from the group consisting of nickel, iron, ruthenium, platinum, rhodium and alloys and combinations thereof.

9. An apparatus in accordance with Claim 7, wherein said at least one methanation catalyst is selected from the group consisting of nickel, iron, ruthenium, platinum, rhodium and alloys and combinations thereof.

10. A method for reducing an amount of CO in a reformate fuel gas comprising CO, H_2, H_2O and CO_2 comprising the steps of:

contacting said reformate fuel gas with at least one water-gas shift catalyst disposed in a reactor vessel at a temperature suitable for reducing said amount of CO in said reformate fuel gas, forming a first stage reformate fuel gas having a reduced CO content;

contacting said first stage reformate fuel gas with a catalyst mixture comprising said at least one water-gas shift catalyst and at least one methanation catalyst at a temperature suitable for further reducing said amount of CO in said

reformate fuel gas, forming a second stage reformate fuel gas having a further reduced CO contact; and

contacting said second stage reformate fuel gas with said at least one methanation catalyst, resulting in a third stage reformate fuel gas in which said CO content is less than about 50 ppm.

11. A method in accordance with Claim 10, wherein said CO content of said third stage reformate fuel gas is less than about 20 ppm.

12. A method in accordance with Claim 10, wherein said at least one water-gas shift catalyst, said catalyst mixture and said at least one methanation catalyst are sequentially disposed in one reactor vessel.

13. A method in accordance with Claim 10, wherein a first stage temperature of said first stage reformate fuel gas is in a range of about 190°C to bout 250°C.

14. A method in accordance with Claim 13, wherein a second stage temperature of said second stage reformate fuel gas is in a range of about 170°C to about 200°C.

15. A method in accordance with Claim 12, wherein a temperature of said catalyst mixture decreases in a direction of said at least one methanation catalyst.

16. A method in accordance with Claim 12, wherein said catalyst mixture comprises a catalyst gradient whereby a concentration of said at least one methanation catalyst in said catalyst mixture increases in a direction towards said at least one methanation catalyst.

17. In a system for generating electricity comprising at least one fuel cell and at least one fuel processor, the improvement comprising:

said at least one fuel processor comprising a reformer vessel suitable for reforming said hydrocarbon fuel to a reformed gas mixture comprising CO, CO_2, H_2O and H_2;

a reactor vessel having a water-gas shift catalyst zone, a mixed catalyst zone downstream of said water-gas shift catalyst zone, and a methanation catalyst zone downstream of said mixed catalyst zone in fluid communication with said reformer vessel; and

at least one water-gas shift catalyst disposed in said water-gas shift catalyst zone, at least one methanation catalyst disposed in said methanation catalyst

zone, and a mixture of said at least one water-gas shift catalyst and said at least one methanation catalyst disposed in said mixed catalyst zone.